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ऑफ़ यूज़ जल शुद्धिकरण प्रणाली —
विशिष्टि

Point of Use Water Purification
System for Arsenic Reduction —
Specification

ICS 130.060.01

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Water Purification Systems Sectional Committee had been approved by the Food and Agriculture Division Council.

Arsenic is a naturally occurring trace element found in rocks, soils and the water in contact with them. Arsenic have shown to cause widespread health effects in humans as a consequence of exposure through drinking-water when present in excessive quantities. Arsenic in soil is mainly derived from its parent rock material, weathering of rocks converting arsenic rich metal sulphides to arsenic trioxides which eventually find its way to into ground water. Long-term intake of arsenic contaminated water leads to arsenic poisoning or arsenicosis, skin damage including keratosis and skin cancer, internal cancers such as that of the lung and bladder, and diseases of the vascular system.

A significant population of the country faces a major health risk due to arsenic contaminated drinking water as many states are reported to be affected by arsenic contamination of groundwater above the permissible level.

Taking cognizance of this situation, the need was felt for formulation of Indian standard for Point of Use (POU) water purifier that reduces Arsenic in water to safe level for potable application. The standard establishes minimum requirements for design and construction, performance, and testing of materials that come in contact with treated water.

The composition of the committee responsible for formulation of the standard is listed in Annex B .

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*).’ The number of significant places retained in the rounded-off value should be the same as that of the specified value in this standard.

Indian Standard

POINT OF USE WATER PURIFICATION SYSTEM FOR ARSENIC REDUCTION — SPECIFICATION

1 SCOPE

1.1 This Standard prescribes requirements, method of sampling and test of media/resin based PoU water purifier that reduces Arsenic in water to safe level for potable application.

1.2 This standard does not cover membrane based PoU water treatment systems for removal of Arsenic in drinking water. A separate Indian Standard IS 16240 for RO based PoU water treatment system for drinking purposes specifies requirement for reduction of arsenic contamination along with other contaminants.

2 REFERENCES

The standards listed below contain provisions, which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

<i>IS No.</i>	<i>Title</i>
IS 302 (Part 1) : 2008	Safety of household and similar electrical appliances: Part 1 General requirement (<i>sixth revision</i>)
IS 3025 (Part 37) : 2022	Method of sampling and test (physical and chemical) for water and waste water: Part 37 Arsenic (<i>second revision</i>)
IS 9845 : 1998	Determination of overall migration of constituents of plastics material and articles intended to come in contact with foodstuffs — Method of analysis (<i>second revision</i>)
IS 10500 : 2012	Drinking Water — Specification (<i>second revision</i>)
IS 16240 : 2015	Reverse osmosis (RO) based point-of-use (PoU) water treatment system for drinking purposes — Specification

3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply:

3.1 Arsenic — It is a chemical element with symbol ‘As’ and atomic number 33. Arsenic is notoriously poisonous to multicellular life in its inorganic form.

3.2 Media — Active material used for the removal of Arsenic.

3.3 Resin — The solid resin is typically an elastic three-dimensional hydrocarbon network containing a large number of ionizable groups electrostatically bound to the resin. These groups are exchanged for ions of similar charge in solution that have a stronger exchange affinity (that is., selectivity) for the resin. Arsenic removal may be accomplished by continuously passing water under pressure through one or more columns packed with strong-base anion (SBA) exchange resin.

3.4 Drinking Water — Water that is intended for human consumption for drinking and cooking purpose from any source in compliance with the acceptable levels specified in the IS 10500 ‘Drinking water — Specification’.

3.5 Daily Production Rate — The volume of product water produced by a system per day.

3.6 Point-of-use Arsenic Removal System — A plumbed-in or faucet-mounted system used to treat the feed water containing arsenic from a single tap for direct consumption or use, but not used to treat the water majority of the facility or for distribution

3.7 Lifetime Purification Capacity — Total volume of drinking water, produced by the purifier, that is within safe limits specified for arsenic.

3.8 Flow Control — A device for controlling the flow rate of a specified stream, specified as litres per minute (lpm) or litres per hour (lph).

3.9 Product Water — Water that has been treated by a system.

3.10 Influent Challenge Level — The standard test water containing specified contaminants entering a system for evaluation. Competing ions that impair arsenic reduction ability of purification system should be specified.

3.11 Chemical Reduction — A reduction in the quantity of arsenic in drinking water.

3.12 Contaminant — An undesirable physical, chemical or microbiological substance or parameter in water that may have an adverse health effect, aesthetic effect or both.

3.13 Treatment Technique (TT) — A process intended to reduce the level of or remove a contaminant in drinking water.

4 CONSTRUCTION REQUIREMENTS

4.1 Inlet Port

The inlet port shall be so designed that it can be connected to the tap, or it can be such that water can easily be poured/fed into the system via this inlet port.

4.2 Method of Mounting

The units for domestic use shall facilitate wall-mounting or counter top, under the sink installation etc.

4.3 Main Components and Installation

4.3.1 Arsenic water purifier shall have the following components if it is a stand-alone unit:

- a) *Sediment Filter/Clarity Filter*: An effective filtration system required to remove the suspended solids like fine particles from water and to remove the turbidity before Arsenic treatment; and
- b) *Filter* or media for the removal of Arsenic from water.

4.3.2 Arsenic water purifier may have regeneration option and/or back wash option (flushing mechanism) if provided by the manufacturer. Arsenic water purifier may have power supply depending on the technology. Power Supply may not be required in case of Arsenic water purifier which are based on media based purification only.

4.4 Material for Construction

4.4.1 Materials in contact with water shall comply with the overall migration limits of 60 mg/l, *max* for various plastic materials when tested by the method prescribed in IS 9845.

4.4.2 Those surfaces of the components of the purifier, which are expected to get wetted by the flow of water through the purifier, shall be made of corrosion-resistant materials or shall have corrosion-resistant treatment or coating of food grade quality. The coatings when applied shall not be soluble in water and shall not peel off at the maximum flow-velocity expected at the surface.

4.4.3 The materials used for construction of the filter chamber shall be pressure resistant to the extent of maximum pressure exerted by the booster pressure. All the material shall be non-leaching type up to the time duration, which is declared by the manufacturer.

4.4.4 All materials which are expected to get wetted by the flow of water through the purifier shall be of food grade material.

4.4.5 Process Media

The manufacturer shall declare the generic technology of arsenic removal and chemicals used in the same including regeneration/back washing/sludge disposal requirement in the user guide of the consumer without compromising their right to patent. Used or spent media/filter shall be taken back by the manufacturer for disposal in an environmentally safe manner, according to guidelines specified in the *Hazardous and Other Wastes (Management and Transboundary Movement) Rules*, 2016.

5 PERFORMANCE REQUIREMENTS

5.1 General

A PoU Arsenic water purifier system shall be so designed and constructed that its intended purpose is accomplished when installed and operated in accordance with the manufacturer's instructions.

5.2 Flow Control

If the performance of a system or component is dependent on a specified flow rate, a pre-set flow control shall be provided as an integral part of the system to regulate the flow.

5.3 Arsenic Reduction

5.3.1 The system shall reduce the Arsenic concentration in the influent challenge to less than or equal to 0.01mg/l which is as per the maximum acceptable limit specified in IS 10500, when tested as per IS 3025 (Part 37). For testing, the influent challenge water shall have minimum 0.30 mg/l of Arsenic.

5.3.2 There are two forms of arsenic: pentavalent arsenic (also called As (V), As (+5), and arsenate) and trivalent arsenic (also called As(III), As (+3), and arsenite). Arsenic reduction is often species dependent. Trivalent arsenic is generally more difficult to reduce from drinking water than pentavalent arsenic. Trivalent arsenic, however, can be converted to pentavalent arsenic in the presence of an effective oxidant such as free chlorine.

5.3.3 The maximum operating Arsenic level in feed water, or the arsenic removal limit, shall be declared by the manufacturer. Reduction claims may be made for:

- Pentavalent arsenic only; and
- Total arsenic reduction (trivalent and pentavalent both).

To qualify for total arsenic reduction claim, a water treatment system shall pass the test for pentavalent arsenic (Arsenate) reduction in accordance with **5.3.3.1**, and also pass a separate test for trivalent arsenic (Arsenite) reduction in accordance **5.3.3.2**.

5.3.3.1 Influent challenge water for testing of pentavalent arsenic (arsenate) reduction

To achieve challenge level of 0.30 mg/l of arsenate in solution, the test water may be generated by adding sodium salt of Arsenic ($\text{Na}_2\text{HAsO}_4 \cdot 7\text{H}_2\text{O}$) to demineralized water to achieve a concentration of 1.28 mg/l of sodium arsenate. This will yield pentavalent arsenic solution (also known as arsenate, As(V), As (+5)). Apart from Arsenic (V), the challenge water shall contain the ions in

specified concentrations as given in Table 1. Alternatively test water may be prepared at challenge level specified by manufacturer. The pentavalent arsenic reduction test shall be performed at pH 6.5 and 8.5. Analysis shall be done on product water, only after adequate flushing of the system is carried out as specified by manufacturer.

5.3.3.2. Influent challenge water for testing of total Arsenic reduction (Arsenate + Arsenite)

Dissolve sodium arsenite (NaAsO_2) in deionized water to achieve the desired challenge concentration. For the challenge concentration of 0.30 mg/l, a concentration of 0.52 mg/l sodium arsenite shall be required. Apart from Arsenic (III), the challenge water shall contain the ions in specified concentrations as given in Table 2. Alternatively test water may be prepared at challenge level specified by manufacturer. The trivalent arsenic reduction test shall be performed at pH 6.5 and 8.5. Analysis shall be done on product water, only after adequate flushing of the system is carried out as specified by manufacturer.

Table 1 Composition of Challenge Water for Testing of Arsenate [As(V)] Reduction Efficacy
(Clause 5.3.3.1)

Sl No.	Parameter	Concentration
(1)	(2)	(3)
i)	Mg^{2+}	12 mg/l
ii)	NO_3^- as N	2 mg/l
iii)	F^-	1 mg/l
iv)	SiO_2	20 mg/l
v)	PO_4^{3-} as P	0.04 mg/l
vi)	Ca^{2+}	40 mg/l
vii)	As(V)	0.3 mg/l
viii)	Residual Free Chlorine	0.25 mg/l – 0.75 mg/l
ix)	pH	6.5 ± 0.25 and 8.5 ± 0.25
x)	Turbidity	< 1 NTU

Table 2 Composition of Challenge Water for Testing of Arsenite [As(III)] Reduction Efficacy
(Clause 5.3.3.2)

Sl No.	Parameter	Concentration
(1)	(2)	(3)
i)	Mg^{2+}	12 mg/l
ii)	NO_3^- as N	2 mg/l
iii)	F^-	1 mg/l
iv)	SiO_2	20 mg/l

Table 2 (Concluded)

Sl No.	Parameter	Concentration
(1)	(2)	(3)
v)	PO ₄ ³⁻ as P	0.04 mg/l
vi)	Ca ²⁺	40 mg/l
vii)	As(III)	0.3 mg/l
viii)	pH	6.5 ± 0.25 and 8.5 ± 0.25
ix)	Dissolved oxygen	<0.5 mg/l
x)	Turbidity	< 1 NTU

5.4 Daily Production and Life of the Filter Media

5.4.1 Daily production capacity for the purified water should not be less than 40 litres and manufacturer should declare the minimum flowrate.

5.4.2 The manufacturer shall declare the life of the cartridge used for Arsenic removal in terms of litres of water purified, calculated at the level of maximum contaminant level claimed by the manufacturer. There should be mechanism to ensure the flow of water does not exceed maximum flow supported for purification. There can be an additional provision for automatic cut-off when the flow is exceeded. If manufacturer suggests the regeneration of the media, a detailed procedure and the required attachments are to be provided by the manufacturer.

5.5 Electrical Safety

5.5.1 If the system works on electricity, the entire electrical circuit shall be insulated from the purifier such that the system shall not have excessive leakage current when tested in accordance with 13 of IS 302 (Part 1).

5.5.2 The system shall be able to withstand high voltage test when tested in accordance with 13 of IS 302 (Part 1).

5.5.3 The system shall have provision for earthing in accordance with 27.5 of IS 302 (Part 1). All parts of metallic construction shall be permanently and reliably connected to an earthing termination within the purifier and shall be free of rough or sharp edges or other hazards that may cause injury to persons adjusting, servicing, or using the system.

NOTE — Class II appliances and Class III appliances shall have no provision of earthing.

5.6 Power Supply

The system shall work on electrical supply up to and including 250 V, 50 Hz for Single Phase and up to and including 440 V, 50 Hz for Three Phase.

5.7 Hydrostatic Pressure Test

5.7.1 Systems designed for working at atmospheric pressure shall be exempted from hydrostatic pressure test, but should be water tight under normal use.

5.7.2 Pressurized water treatment systems shall be tested by hydrostatic test at pressure of 294.24 kPa, or recommended working pressure, whichever is higher.

5.7.3 Leakage of the unit to be tested by closing the outlet of the purifier. There shall not be any leakage from any of the joints, bowls, connectors etc when the pressurized unit is held for 15 min. Initially, hydrostatic pressure to be raised slowly so that the required pressure is reached within 5 min.

5.7.4 The pressurization to be done on the entire unit from the Inlet port till the outlet port at 196.16 kPa pressure.

5.7.5 Manufacturer should specify pressure head required for pushing water through the system, for units not running on electrical power.

6 MAINTENANCE OF THE PRODUCT

6.1 Most of the Arsenic removal systems contain a replaceable treatment component critical for effective reduction of Arsenic. The product water shall be tested periodically by maintenance service provider to verify that the system is performing satisfactorily. Alternatively, there can be mechanism to indicate the consumer about the performance of filter or media periodically and when the filter life is exhausted an indicator or such mechanism which can communicate to consumer about filter or media replacement or regeneration can be given.

6.2 For all filtration components such as sediment filter (if present), activated carbon filter (if present) and arsenic removal cartridge, manufacturer shall declare the maximum possible life in terms of liters of water, which can be processed through each filter.

Factors affecting the performance of the filters shall be mentioned. All this information shall be provided in the user manual.

6.3 Leaving the media/resin dry could impair its arsenic reduction capability. The design should provide for the water lock system to retain water for up to about a month in case filter is unused for some time.

6.4 The manufacturer shall give explicit instructions in the user manual about the cleaning or back flushing of the unit.

7 CAUTION

The manufacturer shall explicitly state the following caution on the label of the Arsenic removal system –

“Arsenic removal system is not recommended for water containing arsenic above 0.30 mg/l concentration.”

8 MARKING

8.1 A name plate shall be fixed on the body of the purifier, at a conspicuous location. The name plate shall be marked with the following details:

- a) Brand name;
- b) Production serial number;
- c) Model name or code;
- d) Maximum flow-rate in l/h;
- e) Life of the cartridges;

- f) Arsenic reduction percent; and
- g) Supply voltage whether single or three-phase, frequency, volts and wattage (if electrically operated).

8.2 BIS CERTIFICATION MARKING

The product may also be marked with the BIS Standard Mark. The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 PACKING

The packing of purifiers shall be as agreed to between the purchaser and the manufacturer.

10 INSTRUCTION MANUAL

An instruction manual for the proper method of operation and use of the purifier shall be supplied along with the purifier. It shall also include the life and specification of all the filters/consumables.

11 SAMPLING

Representative samples of the arsenic removal systems shall be drawn and the criteria of conformity to this standard shall be established according to the method described in Annex A.

ANNEX A
(Clause 11)

SAMPLING PLAN FOR POU ARSENIC REMOVER

A-1 Samples of Product water shall be collected after emptying the storage tank (if available). Allow at least 1 litre of product water to flow and collect sample. While collecting challenge test water, care must be taken that the sampling point is just before the entry into the product. When the Arsenic remover is new, follow manufacturer's instruction for flushing before initiating any tests. Use challenge water for this purpose.

A-2 Arsenic Removal Efficiency Testing

Conduct Arsenic reduction tests on 3 different products independently. Challenge water shall be made in accordance to claims of Arsenate or Total Arsenic reduction as per levels given in Tables 1 and 2 respectively. Make sure Arsenic solution do not precipitate while preparing challenge water. Challenge water is to be prepared in chlorine-free deionized water. Testing Laboratories shall standardize the sequence of addition of Arsenic salts into Challenge water to avoid precipitation.

Three units shall be conditioned in accordance with

the manufacturer's instruction using test waters specified in the above table. The Units shall be tested using the appropriate influent challenge water at the maximum input water pressure prescribed by the manufacturer.

A- 3 Sampling Frequency

The samples are to be collected at 0 percent, 25 percent, 50 percent, 75 percent, 100 percent and 120 percent of the life claimed by the manufacturer. Both challenge water and the post water is to be collected at the same time and is to be analyzed. Initial sampling is to be done after conditioning of the unit as specified by the manufacturer.

A-4 Summary of Method

To check the Arsenic reduction claim, the system shall reduce the level of the Arsenic concentration from the influent challenge level to less than or equal to the maximum acceptable limit of 0.010 mg/l in all product water samples.

ANNEX B
(Foreword)

COMMITTEE COMPOSITION

Water Purification Systems Sectional Committee, FAD 30

<i>Organization</i>	<i>Representative(s)</i>
CSIR - National Environmental Engineering Research Institute, Nagpur	DR P.K. LABHASETWAR (Chairperson)
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Bhavan's Research Center (Microbiology), Mumbai	DR SANDHYA SHRIVASTAVA DR NISHITH DESAI (<i>Alternate</i>)
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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website- www.bis.gov.in or www.standardsbis.

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